A sheet buffering means and method for buffering sheets

The present invention concerns sheet buffering means for placement between paper handling equipment, such as a printer, offset press, copying machine or paper collator, and paper finishing equipment, such as for stapling and/or folding and a method for buffering sheets.

Background art

Copying machines and printers become more and more productive and the number of sheets fed out per period of time increase. A characteristic that also has become common is that the sheets are fed out in showers of, for example, two to eight sheets with a pause in between. For example, three sheets are fed out closely after each other thereafter a pause occurs and thereafter three sheets in close series.

It is common that the paper finishing equipment is mounted after the paper handling equipment, such as the printer or paper collator, in the form of equipment for compiling, stapling, folding, foldprocessing, such as square back folding, book production or mailinserting. The paper finishing equipment which is to process the sheets must generally be able to process these in the speed of flow present in the middle of a shower. This requires very quick equipment which therefore are expensive to manufacture, buy and service due to the requirement of speed. In order to be able to use more simple, less expensive equipment which do not meet the requirement of speed a time gap should be needed to provide for in chosen positions in the process.

Previously known art

One way of attempting to solve the problems above is shown in US5289251. The buffering system comprises a number of paper paths and driving pairs of rollers. In an intermediate step a

special paper path is provided for the buffering of one or more sheets by means of a pair of rollers stopping the feeding of the leading edge of the sheet while the sheet still is fed forward, which causes the sheet to bend upwards and whereupon the following edge of the sheet "flips" over the rear pair of rollers and places itself flat thereupon. After this, a second sheet may be fed underneath the overhead sheet, whereupon these thereafter may be fed out together but with a small dislocation.

This system solves the time problem but shows some disadvantages, for example, it is a problem that printers/copying machines and/or other paper handling equipment are mounted length wise together with subsequent paper finishing equipment in several steps. The equipment of today form very long chains which become difficult to place. The buffering system of US5289251 buffers flat sheets which makes this part of the equipment space requiring. In special cases the customer may not physically be able to fit another part of equipment into their process chain. Another problem is the need of long paper paths. Complicated paper paths are expensive to manufacture and have in paper machines. In order to keep the costs at a low level the paper paths must as far as possible be short and simple.

Summary of the invention

The present invention aims to solve these problems and does so by means of a sheet buffering means according to claim 1 and a method of buffering sheets according to claim 9.

The advantages with the present invention are that it can be made very short seen in the length extension of the process chain due to the bending of the sheet/sheets which is sustained during the whole time of buffering. Additionally, the number of paper paths may be considerably decreased as above all, their

length and complicity. This brings about a more simple, less expensive, more compact and more easily handled means.

Short description of the drawings

An embodiment of the invention will now be described as an example in conjunction with the drawings, in which:

Fig. 1 shows a preferred embodiment of sheet buffering means according to the present invention,

Fig. 2 shows driving of the rollers in the preferred embodiment of Fig. 1.

Detailed description of a preferred embodiment

Fig. 1 shows sheet buffering means intended to buffer up to two sheets 7, comprising an upper buffering path 11 and a lower buffering path 12. Firstly, for the sake of clarity, the upper buffering path 11 will be described on its own. Of course the sheet buffering means may comprise only one buffering path for the buffering of only one sheet if so desired.

A sheet 7 is guided by means of a flap 5 into a rear pair of rollers 13 comprising a driven roller 1 and a counter roller 8. The rear pair of rollers 13 feeds the sheet 7 forward so that it reaches a front pair of rollers 14 comprising a driven roller 2 and a counter roller 9.

When the lead end 16 of the sheet 7 reaches at least the nip 15 of the front pair of rollers 14, the front pair of rollers 14 is stopped whereby the lead end 16 of the sheet 7 is held in place in the nip 15. Meanwhile, the rear pair of rollers 13 continues to feed the sheet 7 forward. Due to this the sheet 7 bend, in this case upwards, since a guide 6 stops the sheet from bending downwards.

The guide 6 is not necessary for the sheet 7 to find the right way to the front pair of rollers 14 but for the sheet 7 to bend in the desired direction. Preferably the guide 6 is slightly bent upwards in order to ease the start of the bending. If so desired, a compliant guide 10 may be provided directed towards the front pair of rollers 14. This compliant guide do not stop the bending of the sheet 7 but stop the sheet 7 from abutting the driving roller 2 in the front pair of rollers 14.

When the trail end 18 of the sheet 7 reaches the nip 17 between the two rollers 1 and 8, or just before the rear pair of rollers 13 also stops and a bent sheet 7 is stored in the sheet buffering means. When the sheet 7 is to be fed out both the front and the rear pair of rollers 14, 13 are started and feed the sheet 7 into subsequent paper finishing equipment. Preferably the pair of rollers are driven at a higher speed when feeding out for additional time savings.

Preferably the rollers 1 and 2 are driven and the counter rollers 8, 9 only follows, but if desired the counter rollers 8, 9 may also be driven, see Fig. 1. Each driven roller 1, 2 may be driven by a motor each, for example an electrical motor, but preferably the rollers 1 and 2 are driven by the same motor 19, whereby the front driving roller 2 is provided with a clutch 22 so that the front roller 2 may be disengaged from the driving force and thus be stopped during the time the lead end 16 of the sheet 7 is held in place. A transmission belt 23 transfer the driving force of the motor 19 to both of the rollers 1 and 2. A friction brake 30 is preferably provided in order to prevent a more rigid sheet of its own motion presses itself through the front pair of rollers 14. The rollers are spring biased towards each other and preferably provided with a flexible material at least at its periphery.

As can be seen in Fig. 1 the lower buffering path 12 is a mirror image of the upper buffering path 11. However, it is conceivable to arrange the upper buffering paths on top of each other or two lower buffering paths on top of each other if so desired. The distance between the two paths must then be increased at such a rate so that a very bent sheet fits in between the two paths. In similar ways more buffering paths may be provided in the same sheet buffering means if so desired.

The flap 5 may be angled between the different buffering paths 11 and 12 (or more if so desired) in order to allow guidance of the sheets 7 to a desired buffering path 11, 12. Preferably, also two short, simple paper paths 20 are provided on each side of the flap 5. Likewise, two short, simple paper paths 21 are preferably provided at the output end 24 of the sheet buffering means for guidance into the subsequent paper finishing equipment.

In order to control the function of the sheet buffering means a signal is needed from the subsequent paper finishing equipment which indicate that it is ready to receive sheets 7, whereby the sheets 7 pass directly through the sheet buffering means without storage. If the paper finishing equipment is not ready, i.e. processing a number of sheets 7 the sheet buffering means is set in active position. When a sheet is detected by an inlet sensor 26 provided at the inlet end 25 of the sheet buffering means the flap 5 is set in an unoccupied position and the driving rollers 1 and 2 are started in the selected buffering path 11, 12.

A front sensor 28 in each buffering path senses when the lead end 16 of the sheet 7 reaches at least the nip 15 between the front driving roller 2 and its counter roller 9 and then disengage the roller 2 from the driving force, whereby the front pair of rollers 14 stops so that the lead end 16 of the sheet 7

is held in place. The inlet sensor 26 senses when the trail end 18 of the sheet 7 soon or absolutely at the latest when it reaches the nip 17 between the rear driving roller 1 and its counter roller 8 and then turns off the motor 19. The flap 5 will then turn to the unoccupied buffering path.

When next sheet 7 comes and the paper finishing equipment still is not ready to receive new sheets 7 this sheet 7 will in the same manner be stored in the sheet buffering means. Then, when the paper finishing equipment is ready to receive new sheets 7 both the pair of rollers 13, 14 of each buffering path will be started, whereby the sheets 7 will be fed out, either from one buffering path at the time or parallel at the same time, or with some intermediate variant of overlap between the sheets 7.

If so desired, a bundle may be fed right through the sheet buffering means without intermediate storage, for example. This is achieved, for example, by the fact that the rollers are springbiased towards each other.

The invention has now been described by means of a preferred embodiment but the skilled person understands that the invention may be varied within the scope of the following claims.